IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant: Kuei-Jen Chang

Group Art Unit: 1763

Serial No.: 09/822,749 Examiner: Mulero Luz L. Alejandro

Filed: March 30, 2001

For: Method and Apparatus for In-Situ Descum/Hot Bake/Dry Etch Photoresist/Polyimide Layer

Attorney Docket No.: 67,200-397

EXPRESS MAIL CERTIFICATE

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Kathy Dixon

APPEAL BRIEF

Mail Stop: Appeal
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Appellants appeal in the captioned application from the Examiner's final rejection, dated April 4, 2003, of claims 1-10, under 35 USC §103(a) as being unpatentable over Admitted Prior Art, Moffat '393 and Collins '414.

It is urged that the rejection be reversed and that all the claims be allowed.

(1) REAL PARTY IN INTEREST

The real party in interest in the present appeal is the recorded Assignee of Taiwan Semiconductor Manufacturing Company, Ltd.

(2) RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences that are known to the Appellants, the Appellants' legal representative, or the assignee.

(3) STATUS OF CLAIMS

Claims 1-10 are pending in the application.

Claims 1-10 stand rejected.

(4) STATUS OF AMENDMENTS

A Request For Reconsideration was filed on or about June 4, 2003.

An Advisory Action was received from the Examiner dated June 16, 2003, maintaining the rejection of all claims.

A Notice of Appeal was filed on or about June 27, 2003.

(5) SUMMARY OF THE INVENTION

The invention relates to a method for in-situ descum/hot bake/dry etch a polyimide photoresist layer and a passivation layer in a single process chamber can be carried out by the steps of providing a process chamber that is equipped with a wafer platform and a wafer backside heating and cooling device; positioning a wafer that has a passivation layer and a patterned polyimide photoresist layer on top of the wafer platform; generating an oxygen plasma in the chamber conducting a descum process; flowing a heated inert gas onto a backside of the wafer conducting a hot bake process; and flowing a cooling inert gas onto the wafer backside conducting a dry etch process for forming a via opening in the wafer.

(Specification, page 7, lines 16 through page 8, line 8)

(6) ISSUE

Is the rejection of claims 1-10 under 35 USC §103(a) as being unpatentable over Admitted Prior Art, Moffat and Collins proper when such references do not teach or suggest the specifically claimed limitations in the present application?

(7) GROUPING OF CLAIMS

The rejection of claims 1-10 are contested as a group.

(8) **ARGUMENTS**

Claims 1-10 are rejected under 35 USC §103(a) as being unpatentable over the admitted prior art in view of Moffat '393 and further in view of Collins '414. It is contended that while the admitted prior art fails to expressly disclose performing all three processes in the same plasma chamber, Moffat discloses performing both baking and descumming resist processes in the same plasma etching chamber. Furthermore, while Moffat fails to show the plasma chamber including a wafer heating and cooling device that heats and cools the wafer via the flowing of inert gas on the backside of the wafer, Collins discloses controlling the substrate temperature using a controller where inert helium gas is used **at the backside of the wafer.**

The rejection of claims 1-10 under 35 USC §103(a) based on the admitted prior art, Moffat and Collins is improper and must be reversed.

While the Appellants agree with the Examiner that the admitted prior art fails to disclose performing all three processes in the same process chamber, the Appellants respectfully submit that such is further not taught or disclosed by Moffat and Collins, combined.

Moffat '393 discloses a wafer processing apparatus which includes a plasma etching unit, a wet processing spin-spray unit, a robotic wafer transfer arm, and a central control computer all contained in the same housing (see Moffat Abstract). The apparatus is designed to perform manufacturing tasks especially related to photoresist processing, photoresist developing, descumming, baking and hardening, and stripping. As shown by Moffat in Fig. 16, and at col. 6, lines 56-58:

> "This processing routine first develops exposed photoresist, then **hardens the resist with heat**, and **removes resist 'scum'**."

Furthermore, at col. 7, lines 3-6, Moffat discloses:

> "With the plasma chamber door closed 139, the unit pulls a vacuum below 1 Torr 140 and **starts the heating lamps**. The heating lamps are run through a predetermined temperature cycle to **hard bake** the photoresist 141."

The present invention, on the other hand, recites a method for in-situ descum/hard bake/dry etch a polyimide photoresist layer in a single process chamber. As clearly recited in independent claim 1:

> "Claim 1. A method for in-situ descum/hot bake/dry etch a polyimide photoresist layer in a single process chamber comprising the steps of:
>
> providing a process chamber ...;
>
> positioning a wafer having a passivation layer ...;
>
> **generating an O_2 plasma** in said chamber **conducting a descum process**;
>
> **flowing a heated inert gas** onto a backside of said wafer **conducting a hot bake process**; and
>
> **flowing a cooling inert gas onto said wafer backside** and **an etchant** into said chamber **conducting a dry etch process** for a via opening on said wafer."

The Appellants respectfully submit that Moffat teaches a process that is patentably distinct from the present invention process in three major elements:

1. Moffat teaches a process of hard bake first and then descum (see Fig. 16), while the present invention teaches a process of descumming first and then hard bake. The sequence is clearly shown by the Appellants at page 12, lines 7-9 of the specification "for conducting in-situ a descum, a hot bake and a dry etch process, sequentially ..." While this was not clearly recited in claim 1, the Appellants would be amenable to amend claim 1 if such amendment is allowed to facilitate the prosecution of the application. In any event, the claims should be read in-light of the specification which sets the meets and bounds of the invention. In the present case, the sequence of steps contained in the specification sets the meets and bounds of claim 1.

2. Moffat teaches a hard bake process by irradiating a wafer with heating, while the present invention teaches and claims a process of hard bake by **flowing a heated inert gas onto a backside of the wafer**. This is not taught by either Moffat or Collins.

3. The Moffat process, as defined in Fig. 16, only contains the **two steps** of hard bake and descum, while the present invention process, as recited in independent claim 1, is a **three step process** of **descum, hard bake and dry etch**.

The Appellants further submit that none of the three major distinctions between the Moffat reference and the present invention method is taught or disclosed by Collins '414 for conducting the three steps in the same process chamber and in the same process.

In the Response to Arguments section of the 04/04/2003 Office Action, the Examiner further noted that "the Examiner respectfully points out that Moffat is not being relied upon to show the hard bake by **flowing a heated inner gas onto a backside of the wafer**, instead, Collins is relied upon to show this limitation". The Appellants respectfully disagree with the Examiner that Collins contains such showing. For instance, at col. 23, lines 23-27:

> "For example, a recirculating closed lop heat exchanger 90 can be used **to flow fluid**, preferably dielectric fluid, **through the block and pedestal of the substrate support/cathode** 32C, as indicated schematically by flow path 91, to cool (and/or heat) the substrate support."

The Appellants respectfully submit that in the cooling method or step disclosed by Collins, the **wafer support block** or **pedestal** is cooled, not the wafer backside. The present invention claim 1, which specifically recites the step of "flowing a cooling inert gas onto said wafer backside" is not taught or disclosed by Collins, Moffat and the admitted prior art. The combined teachings of the three references does not teach such process step.

The rejection of claims 1-10 under 35 USC §103(a) based on the admitted prior art, Moffat and Collins is improper and must be reversed.

CLOSING

In summary, the Appellants have shown that their claimed invention is fully supported by a body of evidence of non-obviousness. It is respectfully submitted that such evidence of non-obviousness overcomes any showing of obviousness presented by

the Examiner. The Appellants therefore submit that the final rejection of their claims 1-10 is improper under 35 USC §103(a).

The reversal of the final rejection is respectfully solicited from the Board.

Respectfully submitted,

Tung & Associates

By: _____

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CLAIM APPENDIX

1. A method for in-situ descum/hot bake/dry etch a polyimide photoresist layer in a single process chamber comprising the steps of:

providing a process chamber equipped with a wafer platform and a wafer backside heating and cooling device;

positioning a wafer having a passivation layer and a patterned polyimide photoresist layer on top on said wafer platform;

generating an O_2 plasma in said chamber conducting a descum process;

flowing a heated inert gas onto a backside of said wafer conducting a hot bake process; and

flowing a cooling inert gas onto said wafer backside and an etchant into said chamber conducting a dry etch process for a via opening on said wafer.

2. A method for in-situ descum/hot bake/dry etch a polyimide photoresist layer in a single process chamber according to claim 1 further comprising the step of conducting said descum process for a time period of less than 30 sec.

3. A method for in-situ descum/hot bake/dry etch a polyimide photoresist layer in a single process chamber according to claim 1 further comprising the step of conducting said hot bake process for a time period of at least 20 sec.

4. A method for in-situ descum/hot bake/dry etch a polyimide photoresist layer in a single process chamber according to claim 1 further comprising the step of conducting said hot bake process by flowing a heated He gas onto said backside of the wafer.

5. A method for in-situ descum/hot bake/dry etch a polyimide photoresist layer in a single process chamber according to claim 1 further comprising the step of conducting said hot bake process by flowing a heated He gas onto said backside of the wafer at a pressure of at least 10 mTorr.

6. A method for in-situ descum/hot bake/dry etch a polyimide photoresist layer in a single process chamber according to claim 1 further comprising the step of conducting said dry etch process for a time period of at least 1 min.

7. A method for in-situ descum/hot bake/dry etch a polyimide photoresist layer in a single process chamber according to claim 1 further comprising the step of conducting said dry etch process while flowing cooling inert gas of He at a pressure of at least 10 mTorr.

8. A method for in-situ descum/hot bake/dry etch a polyimide photoresist layer in a single process chamber according to claim 1 further comprising the step of conducting said descum process at a chamber pressure of less than 1500 mTorr and a plasma power of less than 150 W.

9. A method for in-situ descum/hot bake/dry etch a polyimide photoresist layer in a single process chamber according to claim 1 further comprising the step of conducting said descum process at an O_2 flow rate of less than 40 sccm and an inert gas flow rate of less than 400 sccm.

10. A method for in-situ descum/hot bake/dry etch a polyimide photoresist layer in a single process chamber according to claim 1 further comprising the step of providing said process chamber with a plasma generating means.

7. FEE DEFICIENCY

NOTE: If there is a fee deficiency and there is no authorization to charge an account, additional fees are necessary to cover the additional time consumed in making up the original deficiency. If the maximum six-month period has expired before the deficiency is noted and corrected, the application is held abandoned. In those instances where authorization to charge is included, processing delays are encountered in returning the papers to the PTO Finance Branch in order to apply these charges prior to action on the cases. Authorization to charge the deposit account for any fee deficiency should be checked. See the Notice of April 7, 1986, 1065 O.G. 31-33.

__X__ If any additional extension and/or fee is required, this is a request therefor to charge Visa Credit Card No. 4756 8461 9568 0263

And/Or

__X__ If any additional fee for claims is required, please charge Visa Credit Card No. 4756 8461 9568 0263

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